LADCO | LAKE MICHIGAN AIR DIRECTORS CONSORTIUM

# REQUEST FOR PROPOSAL

## Evaluating Surface Ozone Sensitivity to Emissions Changes in the Great Lakes Region

The Lake Michigan Air Directors Consortium (LADCO) is seeking contractor assistance to conduct gridded air quality modeling and analysis to evaluate the sensitivity of ground-level ozone concentrations to changes in precursor emissions.

Proposals must be received no later than 5 p.m. Central on May 8, 2020. An electronic PDF copy of the proposal is required and should be sent to:

Zac Adelman
Executive Director
Lake Michigan Air Directors Consortium
adelman@ladco.org

No late proposals will be accepted, and the offer shall remain effective for a period of 60 days from the date of the mailing.

Your response to this Request for Proposal (RFP) should include a complete technical proposal that describes your approach for accomplishing the activities outlined below in the Scope of Work. The technical proposal should include a draft work plan that clearly describes your technical activities, schedule, and deliverables. The technical proposal should include a summary of your capabilities and your experience in the field of work. Include a complete cost proposal with a detailed breakdown of projected expenditures by task, including person hours and other direct charges. LADCO does not anticipate there being any travel expenses for this project.

Please limit the proposal to 15 pages (single-spaced, 12-point font).

In addition, your response should include an appendix with supplemental information, such as references, resumes, and descriptions of recent relevant work. The supplemental information has no page limit.

All contracts will be issued by LADCO and managed by LADCO's Executive Director. It is anticipated that LADCO will award a fixed price contract as a result of this solicitation. LADCO may consider awarding another type of contract, provided that its use is consistent with the objectives and interests of the Consortium.

Funds available for this contract are federal funds from the U.S. Environmental Protection Agency (EPA) and contractors must meet requirements associated with the use of federal funds (2CFR 200).

All information and data produced and delivered under this contract will be in the public domain. While LADCO does not anticipate restricting the publication or presentation of results obtained from this study, LADCO reserves the right to review all presentations and manuscripts derived from this study.

LADCO will make positive efforts to utilize small, minority business enterprises (MBE), women's business enterprises (WBE), and disadvantaged business enterprises (DBE), whenever possible.

Details of the LADCO procurement process, including draft contract terms, are available in the LADCO Procurement Policy Manual.

All inquiries regarding this RFP should be directed to Zac Adelman (adelman@ladco.org) no later than 5 p.m. Central on April 27, 2020. LADCO will post responses to all received inquiries to the LADCO website RFPs page by April 29, 2020. Bidders are encourage to submit their questions before April 27. LADCO will make every effort to post answers within a day or two of receiving inquiries in order to allow bidders sufficient time to adjust their proposals, if needed, based on LADCO's responses.

We expect to award the project and enter a contract with the winning bidder by June 1, 2020.

If your organization would like to be included on the interested bidders list for this and subsequent work, then please send an email to the LADCO Executive Director with your email address and contact information.

# Scope of Work

## Introduction

Ozone concentrations at monitors in rural and urban areas in the LADCO region have consistently violated the National Ambient Air Quality Standards (NAAQS) for ozone over the last 40 years. Emissions of the ozone precursors, nitrogen oxides ($NO_x$) and volatile organic compounds (VOC), have decreased since the 1990s, with emissions from anthropogenic sources of both precursors falling more than 50% from 2002 to 2014. While these reductions have helped to decrease monitored ozone concentrations, ambient ozone has not declined at nearly the same rate as the ozone precursor emissions. The US EPA also lowered the ozone standard in 2015 to 70 ppb. As a result, EPA designated several areas in the LADCO region as nonattainment for the 2015 ozone NAAQS.

According to the US EPA National Emissions Inventory (NEI), anthropogenic NOx and VOC emissions declined across the LADCO region by 35% and 18%, respectively, between 2010 and 2017[1]. Table 1 shows that for NOx, the emissions changes were driven primarily by reductions in stationary source electricity production (EGU Point) and mobile sources. The VOC reductions came primarily from declining mobile source and other nonpoint (mostly petroleum storage and transport) emissions. Table 1 also shows that despite the emissions reductions in some inventory sectors, there are sectors that both continued to be large regional sources of ozone precursors in the 2017 NEI, and that have significant reduction potential. Off-highway mobile is the second largest regional source of NOx emissions (493,404 TPY), but only declined 16% from 2010 to 2017. Volatile chemical products (606,191 TPY) is the largest source of anthropogenic VOC emissions in the region and only declined 2% from 2010 to 2017.

[1] https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data

**Table 1. LADCO Region NOx and VOC Emissions Summary from the NEI2017***

| | NOx | | | VOC | | |
|---|---|---|---|---|---|---|
| **Tier 1 Inventory Category** | **2017 NEI (tons/yr)** | **2017-2010 (tons)** | **% diff** | **2017 NEI (tons/yr)** | **2017-2010 (tons)** | **% diff** |
| Onroad Mobile | 567,023 | -478,277 | -46% | 305,551 | -216,750 | -41% |
| Offroad Mobile | 493,404 | -93,058 | -16% | 404,624 | -109,273 | -21% |
| EGU Point | 212,844 | -343,817 | -62% | 7,757 | -1,085 | -12% |
| Non-EGU Point[1] | 472,983 | -33,034 | -7% | 288,797 | 11,265 | 4% |
| Volatile Chemical Products[2] | 3,040 | -302 | -9% | 606,191 | -13,402 | -2% |
| Other Nonpoint[3] | 19,122 | -243 | -1% | 142,430 | -49,570 | -26% |

*NEI2014v2 analysis from March 8, 2019

[1] Fuel combustion industrial, fuel combustion other, other industrial, petroleum and related industries, metals processing

[2] Chemical and allied product manufacturing, solvent utilization

[3] Petroleum storage and transport, waste disposal and recycling, miscellaneous

The general concept of this project is to use a gridded chemistry-transport model to better understand the drivers of surface ozone episodes in the LADCO region. Modeling of year 2016 ozone episodes should be conducted to quantify the ozone sensitivity to changes in precursor emissions from different inventory source sectors. Sensitivities of ozone concentrations to changes in NOx or VOC emissions should be calculated for receptor areas in the LADCO region that are classified as either in nonattainment or maintenance of the 2015 ozone NAAQS.

This project should produce modeling results that can be used to evaluate a wide-range of ozone mitigation options. The modeling should present the impacts to surface ozone concentrations along a spectrum of NOx, VOC, or NOx and VOC emissions reduction levels (10%-100%) from different inventory source categories. Proposals that use numerical sensitivity

techniques, such as the High-Order Decoupled Direct Method[2] or adjoint versions of a gridded model[3], are favored over proposals that suggest the use of brute-force sensitivity methods. One product from this project could be receptor-specific response surfaces that present how ozone concentrations are estimated to respond to changes in precursor emissions from different inventory sectors. Ultimately, we are seeking proposals for innovative applications of air quality models that can best address LADCO's need to evaluate surface ozone mitigation strategies using recent data and state-of-the-art modeling techniques.

Figure 1 is a heatmap of daily maximum 8-hour average ozone concentrations in different cities in the LADCO region. Candidate episodes in 2016 could include April 15-20, May 22-26, June 9-13, June 18-20, July 19-23, or August 3-11. In the proposal, the contractor shall discuss the feasibility (timing and computational) of simulating the entire 2016 ozone season (April-September) versus short-duration, high-ozone episodes based on how they plan to conduct the sensitivity modeling. The inventory sectors that should be considered for this analysis include: onroad mobile gasoline vehicles, onroad mobile diesel vehicles, nonroad mobile, volatile chemical products, other nonpoint, electricity generation point, and non-electricity point. The ozone sensitivities should be calculated for the receptor areas listed in Table 2. For the larger areas that include multiple surface ozone monitoring sites, the sensitivities should also be calculated for model grid cells in the immediate vicinity of NAAQS attainment controlling monitor(s).

2 Zhang et al., Development of the high-order decoupled direct method in three dimensions for particulate matter: enabling advanced sensitivity analysis in air quality models, *Geosci. Model Dev*., 5, 355–368, 2012 www.geosci-model-dev.net/5/355/2012/ doi:10.5194/gmd-5-355-2012

3 Hakimi et al., The Adjoint of CMAQ, *Environ. Sci. Technol.* 2007, 41, 22, 7807-7817

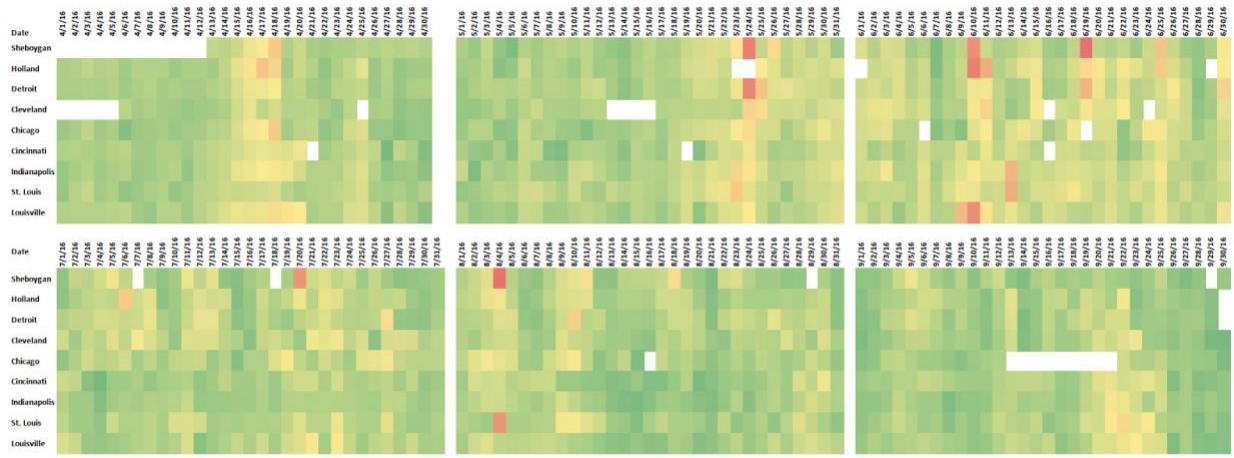


**Figure 1. Heat map of 2016 daily MDA8 ozone concentrations in the LADCO region, grouped by month**

**Table 2. 2015 O3 NAAQS Nonattainment and Maintenance Areas in the LADCO region**

| Area Name | State(s) | Designation | 2016-18 O3 DV (ppb) |
|---|---|---|---|
| Chicago | IL/IN/WI | Marginal | 0.079 |
| St. Louis | IL/MO | Marginal | 0.074 |
| Louisville | IN/KY | Marginal | 0.075 |
| Cincinnati | OH/KY | Marginal | 0.075 |
| Columbus | OH | Maintenance | 0.069 |
| Cleveland | OH | Marginal | 0.074 |
| Detroit | MI | Marginal | 0.074 |
| Berrien County | MI | Marginal | 0.073 |
| Allegan County | MI | Marginal | 0.073 |
| Muskegon County | MI | Marginal | 0.076 |

| | | | |
|---|---|---|---|
| Milwaukee | WI | Marginal | 0.074 |
| Sheboygan County | WI | Marginal | 0.081 |
| Manitowoc County | WI | Marginal | 0.073 |
| Door County | WI | Marginal | 0.073 |

## Objective and Goals

The objective of this project is to quantify the surface ozone changes from reducing the emissions of NOx or VOCs from different inventory sectors. A gridded, regional-scale air quality model will be used to simulate the changes in ozone from reducing ozone precursor emissions in the LADCO region. Analysis of the changes in ozone concentrations will focus on counties in 2015 O3 NAAQS nonattainment and maintenance areas in the LADCO region.

The goal of this study is to identify optimal ozone reduction strategies for key receptor areas in the LADCO region.

## Technical Tasks

Under this contract, the contractor shall perform the following technical tasks, with the results of these tasks to be thoroughly discussed and interpreted in a project final report. The contractor shall provide separate statements of work and cost estimates for each task.

### Task 1. Project Initialization and Modeling Protocol

LADCO will provide all of the input data in CAMx format, including initial and boundary conditions, emissions, meteorology, and other CAMx inputs. Although these data will be provided in CAMx-format because that is what is readily available from LADCO, proposals that suggest the use of other models, such as CMAQ or WRF-Chem, are encouraged. It will be the contractor's responsibility to perform any data format conversions to support their proposed modeling approach.

In this task, the contractor shall collect the 2016 CAMx input data from LADCO to support 4-km gridded ozone modeling. LADCO will provide 2016 meteorology data in either WRF or WRFCAMx formats. LADCO will also provide CAMx-ready 2016 emissions files by sector, and

merged together in gridded and/or point source formats. LADCO will provide 2016 CAMx initial conditions and hourly boundary conditions files derived from a CAMx 2016 12-km simulation. Other inputs for CAMx, such as ozone columns and clear sky photolysis rates, can also be provided by LADCO, as needed.

The contractor shall develop a draft modeling protocol that describes the data sources and model configuration that will be used to simulate the ozone sensitivities. The protocol should detail the approach for quantifying the ozone sensitivities to precursor emissions from different inventory sectors and include a description with example graphics of how the sensitivity results will be presented. If episodic modeling is to be conducted, the contractor will work with LADCO to identify the ozone episodes that will be simulated to quantify the ozone sensitivities in the LADCO region.

The contractor shall share this protocol with LADCO for comment and produce a final protocol that addresses the comments from LADCO.

**Task 1 Deliverables:**

1. Draft air quality modeling protocol
2. Final air quality modeling protocol

### Task 2. Sensitivity Modeling to Quantify Ozone Sensitivity in the LADCO Region

In this task the contractor shall set up and implement the air quality model described in the modeling protocol. The contractor shall use the model to simulate ground level ozone in 2016 for the time periods described in the protocol. The model shall be instrumented to track the sensitivity of ozone formation to precursor emission reductions from different inventory sectors.

The contractor shall conduct a model performance evaluation of ozone and, where applicable, ozone precursors through comparison of the 4-km gridded modeling results to ambient observations available through publicly accessible databases, such as the U.S. EPA Air Quality System (AQS). The results of the model performance evaluation shall be summarized and delivered to LADCO in a presentation and as a chapter in the final project report. A discussion of

the implications of model performance deficiencies on the subsequent sensitivity analyses shall be included in the presentation and final report chapter.

The contractor shall deliver to LADCO the CAMx modeling scripts and configuration files used for this simulation along with all CAMx output data.

**Task 2 Deliverables:**

1. Powerpoint presentation describing the model performance for ozone and ozone precursors during the modeling time periods
2. Final report chapter on the base year model performance
3. CAMx run scripts and output data

### Task 3. Ozone Sensitivity Analysis and Interpretation

In this task the contractor shall post-process the ozone sensitivity modeling results from Task 2 and present them to LADCO in a manner that describes the influence of different emissions sources on ozone in the receptor areas defined in Table 2. Of particular interest to LADCO would be a result that shows how ozone in each of the receptor areas responds to various levels of NOx, VOC, or NOx and VOC emissions reductions. The questions that we would like to answer with these results include:

1. How do ozone concentrations at a receptor change when total NOx, VOC, or NOx and VOC emissions are reduced along a spectrum of 10% to 100% reduction?
2. Expanding on Question 1, rather than looking at total NOx, VOC, or NOx and VOC emissions reductions, how do ozone concentrations at a receptor change when emissions are reduced from onroad mobile gasoline vehicles, onroad mobile diesel vehicles, nonroad mobile, volatile chemical products, other nonpoint, electricity generation point, or non-electricity point sources?
3. Which combination(s) of NOx, VOC, and inventory sector has the largest impact (reduction) on peak ozone formation periods in each receptor area?
4. What are the periods in the diel within which sectorized emissions reductions have the largest impact on mitigating daily peak ozone concentrations during ozone exceedance days? In other words, emissions reductions from which sectors and when have the largest impact on mitigating ozone exceedances in each receptor?

While LADCO envisions that ozone response surfaces or ozone isopleths for each receptor area by inventory sector may be useful products of this analysis, we are seeking creative proposals to help us answer these questions, and to develop other analysis products that will help us identify emissions reduction strategies to attain the 2015 ozone NAAQS in each of the NAAs in the LADCO region.

The results of the ozone sensitivity analysis shall be summarized and delivered to LADCO in a presentation and as a chapter in the final project report. The presentation and report chapter shall describe the methods used for the analysis, the results of the analysis, and the contractor's interpretation of the results. A summary and recommendations section in the presentation and report shall convey the contractor's opinions, based on the modeling results from this project, on the optimal 2015 ozone NAAQS attainment strategies for each of the receptor areas in Table 2.

The contractor shall deliver to LADCO the software, if applicable, and scripts used in the analysis for this task.

**Task 3 Deliverables:**

1. Powerpoint presentation describing and interpreting the ozone sensitivity analysis
2. Final report chapter on the ozone sensitivity analysis, including recommendations for ozone control strategies in each LADCO receptor area
3. Analysis software and scripts

### Task 4. Project administration and final report

At the beginning of the project, the contractor shall develop a draft workplan describing the approach they plan to take to address Tasks 1 through 3, including a project timeline and schedule of deliverables. They shall share this workplan with LADCO for comment. The contractor shall produce a final workplan that addresses the comments from LADCO.

During the project, the contractor shall have regularly (at least monthly) scheduled calls with LADCO to discuss the progress of the work. The contractor shall take and circulate notes and action items from these calls with LADCO.

At the end of the project, the contractor shall provide a draft final report outline to LADCO for comment. The contractor shall develop a draft final report based on the report outline that documents the air quality modeling, the ozone sensitivity analyses, and recommendations for ozone control strategies for each LADCO receptor area (Table 2).

The contractor shall share the draft final report with LADCO for comment. The contractor shall produce a final report that addresses the comments received from LADCO on the draft report.

**Task 4 Deliverables:**

1. Draft workplan
2. Final workplan
3. Monthly conference calls, notes, and action items
4. Draft outline of report
5. Final outline of report
6. Draft report
7. Final report

# Proposal Requirements

## Proposals should include the following elements:

1. Project statement - summarize the project from the perspective of the bidder
2. Technical proposal - detail the approach by task used to accomplish the objectives and requirements of the project
3. Project Timeline - detail the schedule of deliverables by task
4. Cost proposal - description of the projected expenditures by task, including person hours and other direct charges
5. Bidder qualifications - description of the qualifications should include years of experience, number of staff, and a narrative highlighting the bidders capabilities
6. MBE/WBE statement - statement of whether the bidder is a registered minority or woman-owned business
7. Appendix - references, resumes, and descriptions of recent relevant work

Please limit proposal elements 1-6 to 15 pages; there is no page limit for element 7.

**Level of Effort and Project Timeline**

The project should be completed by December 31, 2020. Additional funding and time considered necessary to conduct a more complete analysis should be included as options to the primary work effort.

**Evaluation Criteria**

The following criteria will be used in evaluating the responses to this RFP. A review panel will score each of the five factors below from 1 (worst) to 5 (best). The proposal with the highest weighted score will be selected for funding.

1. Project statement: 10%
2. Technical proposal: 45%
3. Cost proposal: 20%
4. Bidder qualifications: 20%
5. MBE/WBE statement: 5%